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1 Designing a universal keyboard using chording gloves

Seongil Lee, Sang Hyuk Hong, Jae Wook Jeon

June 2002 **ACM SIGCAPH Computers and the Physically Handicapped , Proceedings of the 2003 conference on Universal usability**, Issue 73-74

Full text available: pdf(544.77 KB) Additional Information: full citation, abstract, references, index terms

A universal input device for both text and Braille input was developed in a Glove-typed interface using all the joints of the four fingers and thumbs of both hands. The glove-typed device works as of now for input of Korean characters, numbers, and Braille characters using mode conversion. Considering the finger force and the fatigue from repeated finger motions, the input switch was made of conductible silicon ink, which is easy to apply to any type of surface, light, and enduring. The usabilit ...

Keywords: chording gloves, device-independence, keyboard, keymap, universal access, usability

2 The influence of muscle groups on performance of multiple degree-of-freedom input

Shumin Zhai, Paul Milgram, William Buxton

April 1996 **Proceedings of the SIGCHI conference on Human factors in computing systems: common ground**

Full text available: pdf(1.44 MB) html(42.34 KB) Additional Information: full citation, references, citings, index terms

Keywords: 3-D interface, 6 DOF input, arm, fingers, hand, homunculus model, input devices, motor control, muscle group differences

3 Expressing guidelines into an ergonomical styleguide for highly interactive applications

François Bodart, Jean M. Vanderdonckt

April 1993 **INTERACT '93 and CHI '93 conference companion on Human factors in computing systems**

Full text available: pdf(210.16 KB) Additional Information: full citation, references, citings

4 A virtual reality-based exercise program for stroke rehabilitation

David Jack, Rares Boian, Alma Merians, Sergei V. Adamovich, Marilyn Tremaine, Michael Recce, Grigore C. Burdea, Howard Poizner

November 2000 **Proceedings of the fourth international ACM conference on Assistive technologies**

Full text available: pdf(837.79 KB) Additional Information: full citation, references, index terms

Keywords: CyberGlove, Rutgers Master II, haptic glove, rehabilitation, stroke, virtual reality

5 Get a grip: managing RSI at MIT

Mary Ellen Bushnell, M. Susan Jones

October 1994 **Proceedings of the 22nd annual ACM SIGUCCS conference on User services**

Full text available: pdf(444.72 KB) Additional Information: full citation, index terms

6 A survey of design issues in spatial input

Ken Hinckley, Randy Pausch, John C. Goble, Neal F. Kassell

November 1994 **Proceedings of the 7th annual ACM symposium on User interface software and technology**

Full text available: pdf(1.20 MB) Additional Information: full citation, abstract, references, citings, index terms

We present a survey of design issues for developing effective free-space three-dimensional (3D) user interfaces. Our survey is based upon previous work in 3D interaction, our experience in developing free-space interfaces, and our informal observations of test users. We illustrate our design issues using examples drawn from instances of 3D interfaces.For example, our first issue suggests that users have difficulty understanding three-dimensional space. We offer a set of strategie ...

Keywords: 3D interaction, ergonomics of virtual manipulation, haptic input, spatial input, two-handed input, virtual reality

7 Deneb/ERGO: a simulation based human factors tool

Narinder Nayar

December 1995 **Proceedings of the 27th conference on Winter simulation**

Full text available: pdf(824.60 KB) Additional Information: full citation, index terms

8 Section 06: objects in space: ComTouch: design of a vibrotactile communication device

Angela Chang, Sile O'Modhrain, Rob Jacob, Eric Gunther, Hiroshi Ishii

June 2002 **Proceedings of the conference on Designing interactive systems: processes, practices, methods, and techniques**

Full text available: pdf(4.16 MB) Additional Information: full citation, abstract, references, index terms

We describe the design of ComTouch, a device that augments remote voice communication with touch, by converting hand pressure into vibrational intensity between users in real-time. The goal of this work is to enrich inter-personal communication by complementing voice with a tactile channel. We present preliminary user studies performed on 24 people to

observe possible uses of the tactile channel when used in conjunction with audio. By recording and examining both audio and tactile data, we found ...

Keywords: communication, haptic interpersonal, remote communication, tactile communication, tangible telepresence, tangible user interface, touch-vibration mapping, vibrotactile

9 Pervasive computing and virtual reality: Adding haptic feedback to engineering simulation

J. Shi, I. A. Oraifige, F. R. Hall

September 2003 **Proceedings of the 1st international symposium on Information and communication technologies**

Full text available: pdf(179.40 KB) Additional Information: full citation, abstract, references

This paper describes the experimental work on engineering simulation using virtual reality techniques with haptic feedback. The role of haptic modality in a VR system and its potential have been investigated. In this paper, a low cost attempt to generate haptic feedback in a VR system is discussed.

10 Haptics and biometrics: TorqueBAR: an ungrounded haptic feedback device

Colin Swindells, Alex Unden, Tao Sang

November 2003 **Proceedings of the 5th international conference on Multimodal interfaces**

Full text available: pdf(614.55 KB) Additional Information: full citation, abstract, references, index terms

Kinesthetic feedback is a key mechanism by which people perceive object properties during their daily tasks - particularly inertial properties. For example, transporting a glass of water without spilling, or dynamically positioning a handheld tool such as a hammer, both require inertial kinesthetic feedback. We describe a prototype for a novel ungrounded haptic feedback device, the TorqueBAR, that exploits a kinesthetic awareness of dynamic inertia to simulate complex coupled motion as both a di ...

Keywords: 1 DOF, haptic rod, input device, mobile computing, tilt controller, torque feedback, two-handed, ungrounded force feedback

11 Non-keyboard QWERTY touch typing: a portable input interface for the mobile user

Mikael Goldstein, Robert Book, Gunilla Alsiö, Silvia Tessa

May 1999 **Proceedings of the SIGCHI conference on Human factors in computing systems: the CHI is the limit**

Full text available: pdf(1.28 MB) Additional Information: full citation, references, citings, index terms

Keywords: PDA, QWERTY, Wizard-of-Oz, keyboard, language model, lexical knowledge, mobile user, portability, stylus input, syntactic knowledge, text input, touch-typing

12 Two-handed virtual manipulation

Ken Hinckley, Randy Pausch, Dennis Proffitt, Neal F. Kassell

September 1998 **ACM Transactions on Computer-Human Interaction (TOCHI)**, Volume 5 Issue 3

Full text available: pdf(1.32 MB) Additional Information: full citation, abstract, references, citings, index terms

We discuss a two-handed user interface designed to support three-dimesional neurosurgical

visualization. By itself, this system is a "point design," an example of an advanced user interface technique. In this work, we argue that in order to understand why interaction techniques do or do not work, and to suggest possibilities for new techniques, it is important to move beyond point design and to introduce careful scientific measurement of human behavioral principles. In particula ...

Keywords: bimanual asymmetry, haptic input, input devices, three-dimensional interaction, two-handed interaction, virtual manipulation

13 The partial-occlusion effect: utilizing semitransparency in 3D human-computer interaction

Shumin Zhai, William Buxton, Paul Milgram

September 1996 **ACM Transactions on Computer-Human Interaction (TOCHI)**, Volume 3 Issue 3

Full text available: pdf(6.54 MB) Additional Information: full citation, abstract, references, citings, index terms

This study investigates human performance when using semitransparent tools in interactive 3D computer graphics environments. The article briefly reviews techniques for presenting depth information and examples of applying semitransparency in computer interface design. We hypothesize that when the user moves a semitransparent surface in a 3D environment, the "partial-occlusion" effect introduced through semitransparency acts as an effective cue in target localization—an ess ...

Keywords: 3D interfaces, depth perception, partial occlusion, semitransparency, stereopsis

14 Quantifying coordination in multiple DOF movement and its application to evaluating 6 DOF input devices

Shumin Zhai, Paul Milgram

January 1998 **Proceedings of the SIGCHI conference on Human factors in computing systems**

Full text available: pdf(1.03 MB) Additional Information: full citation, references, citings, index terms

Keywords: 3D interfaces, 6 DOF control, coordination, evaluation methods, input devices, interaction techniques, mental rotation, motor control, rotation, virtual environments

15 Rendering systems on clusters: Approach for software development of parallel real-time VE systems on heterogenous clusters

C. Winkelholz, T. Alexander

September 2002 **Proceedings of the Fourth Eurographics Workshop on Parallel Graphics and Visualization**

Full text available: pdf(546.54 KB) Additional Information: full citation, abstract, references, citings, index terms

This paper presents our approach for the development of software for parallel real-time virtual environment systems (VE) running on heterogenous clusters of computers. This approach is based on a framework we have developed to facilitate the set-up of immersive virtual environment systems using single components coupled by an isolated local network. The framework provides parallel rendering of multiple projection screens and parallel execution of application and interaction tasks on components s ...

16 User performance in relation to 3D input device design
Shumin Zhai
November 1998 **ACM SIGGRAPH Computer Graphics**, Volume 32 Issue 4

Full text available: pdf(1.03 MB) Additional Information: full citation, abstract, citings, index terms

Based mainly on a series of studies the author conducted at the University of Toronto, this article reviews the usability of various six degrees of freedom (6 DOF) input devices for 3D user interfaces. The following issues are covered in the article: the multiple aspects of input device usability (performance measures), mouse based 6 DOF interaction, mouse modifications for 3D interfaces, free-moving isotonic 6 DOF devices, desktop isometric and elastic 6 DOF devices, armature-based 6 DOF device ...

17 Systems, interactions, and macrotheory
Philip Barnard, Jon May, David Duke, David Duce
June 2000 **ACM Transactions on Computer-Human Interaction (TOCHI)**, Volume 7 Issue 2

Full text available: pdf(1.60 MB) Additional Information: full citation, abstract, references, citings, index terms, review

A significant proportion of early HCI research was guided by one very clear vision: that the existing theory base in psychology and cognitive science could be developed to yield engineering tools for use in the interdisciplinary context of HCI design. While interface technologies and heuristic methods for behavioral evaluation have rapidly advanced in both capability and breadth of application, progress toward deeper theory has been modest, and some now believe it to be unnecessary. A case ...

Keywords: cognitive models, computing system models, models of interaction

18 Queries-R-Links: graphical markup for test navigation
Gene Golovchinsky, Mark Chignell
May 1993 **Proceedings of the SIGCHI conference on Human factors in computing systems**

Full text available: pdf(809.83 KB) Additional Information: full citation, abstract, references, citings, index terms

In this paper we introduce a style of interaction (interactive querying) that combines features of hypertext with Boolean querying, using direct markup of text to launch queries. We describe two experiments that compare the relative ease of expressing Boolean queries as text versus a graphical equivalent. The results of these experiments show that the expression of queries in the graphical format is no more difficult than the textual equivalent. We then describe the Queries-R-Links system t ...

Keywords: hypertext, navigation, pen-based interaction, querying, text retrieval

19 Navigation as multiscale pointing: extending Fitts' model to very high precision tasks
Yves Guiard, Michel Beaudouin-Lafon, Denis Mottet
May 1999 **Proceedings of the SIGCHI conference on Human factors in computing systems: the CHI is the limit**

Full text available: pdf(1.11 MB) Additional Information: full citation, references, citings, index terms

Keywords: Fitts' law, graphical tablet, input devices, mouse, multiscale interfaces, navigation, pointing, stylus

20 Section 01: augmented education: A group game played in interactive virtual space: design and evaluation

Hanna Strömberg, Antti Väätänen, Veli-Pekka Räty

June 2002 **Proceedings of the conference on Designing interactive systems: processes, practices, methods, and techniques**

Full text available: pdf(2.31 MB) Additional Information: full citation, abstract, references, index terms

We have designed and evaluated Nautilus -- a group game played in interactive virtual space. This was a study about new kinds of computer games with new types of user interfaces. Our aim was to reduce the boundaries between the surrounding physical space and the virtual space designed to appeal to users' senses. We utilized the iterative Human-Centred Design (HCD) approach in the study. We created a new way to experience and play computer games, where players use their natural body movements and ...

Keywords: computer games, human-centred design, shared experiences, user interface, virtual space

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1 The new design: the changing role of industrial engineers in the design process through the use of simulation
Deidra L. Donald, Nick Andreou, Jeffrey Abell, Robert J. Schreiber
December 1999 **Proceedings of the 31st conference on Winter simulation: Simulation---a bridge to the future - Volume 1**
Full text available: pdf(62.21 KB) Additional Information: full citation, citings, index terms

2 Hedonic and ergonomic quality aspects determine a software's appeal
Mare Hassenzahl, Axel Platz, Michael Burmester, Katrin Lehner
April 2000 **Proceedings of the SIGCHI conference on Human factors in computing systems**
Full text available: pdf(812.65 KB) Additional Information: full citation, abstract, references, citings, index terms

The present study examines the role of subjectively perceived *ergonomic quality* (e.g. simplicity, controllability) and *hedonic quality* (e.g. novelty, originality) of a software system in forming a judgement of appeal. A hypothesised research model is presented. The two main research question are: (1) Are ergonomic and hedonic quality subjectively different quality aspects that can be independently perceived by the users? and (2) Is the judgement of appeal formed by combining and ...

Keywords: emotional usability, hedonic components, joy of use, perceived software quality

3 A tutorial on ergonomics and process modeling using QUEST and IGRIP
Deidra L. Donald
December 1998 **Proceedings of the 30th conference on Winter simulation**
Full text available: pdf(497.02 KB) Additional Information: full citation, references, index terms

4 Ergonomics of wearable computers
Chris Baber, James Knight, D. Haniff, L. Cooper
March 1999 **Mobile Networks and Applications**, Volume 4 Issue 1

Full text available: pdf(601.53 KB) Additional Information: full citation, abstract, references, citings, index terms

Wearable computers represent a new and exciting area for technology development, with a host of issues relating to display, power and processing still to be resolved. Wearable computers also present a new challenge to the field of ergonomics; not only is the technology distinct, but the manner in which the technology is to be used and the relationship between user and computer have changed in a dramatic fashion. In this paper, we concentrate on some traditional ergonomics concerns and exami ...

5 Ergonomic studies in computer aided design

G. H. van der Heiden, E. Grandjean

June 1984 **Proceedings of the 21st conference on Design automation**

Full text available: pdf(580.78 KB) Additional Information: full citation, abstract, references, index terms

Although there is a large amount of research publications available on the ergonomics of Visual Display Terminals, only few authors applied human factors' thoughts in a CAD-environment. This paper describes the results of an ergonomic survey on interactive graphics workstations. Starting from an analysis of specific characteristics of CAD-operation, areas of improvement in workstation design can be deduced.

6 The applied ergonomics group at Philips

Ian McClelland

May 1993 **Proceedings of the SIGCHI conference on Human factors in computing systems**

Full text available: pdf(232.33 KB) Additional Information: full citation, references, index terms

7 Would your product pass?: ergonomics testing for software begins in Germany

Pat Billingsley

January 1995 **ACM SIGCHI Bulletin**, Volume 27 Issue 1

Full text available: pdf(253.10 KB) Additional Information: full citation, index terms

8 An overview of ergonomic considerations in computer systems

M. L. Schneider, F. B. Arble, N. Olson, D. Wolff

June 1980 **Proceedings of the 17th annual computer personnel research conference**

Full text available: pdf(478.11 KB) Additional Information: full citation, abstract, references, index terms

The ergonomic considerations in computer systems involve an examination of hardware and software components. This paper examines some of the topics that must be considered in the design of a useful system. The state of the art in this area is underdeveloped. Thus, there is little hard data upon which to base design decisions.

9 Looking for usability problems with the ergonomic criteria and with the ISO 9241-10 dialogue principles

J. M. Christian Bastien, Dominique L. Scapin, Corinne Leulier

April 1996 **Conference companion on Human factors in computing systems: common ground**

Full text available: pdf(243.05 KB) Additional Information: full citation, references, index terms

10 The cognitive ergonomics of knowledge-based design support systems

Tamara Sumner, Nathalie Bonnardel, Benedikte Harstad Kallak
March 1997 **Proceedings of the SIGCHI conference on Human factors in computing systems**
Full text available: pdf(1.28 MB) Additional Information: full citation, references, citings, index terms

Keywords: cognitive ergonomics, critiquing systems, design, design environments, knowledge-based systems, phone-based interfaces

11 Ergonomics—the miracle drug for terminal illness at MIT?
Christi-Anne Castro
November 1993 **Proceedings of the 21st annual ACM SIGUCCS conference on User services**
Full text available: pdf(416.61 KB) Additional Information: full citation, references, index terms

12 HCI overviews: HCI group of the department of ergonomics and psychology at the Budapest University of Technology and Economics
Lajos Izsó, Károly Hercegfi
April 2004 **Extended abstracts of the 2004 conference on Human factors and computing systems**
Full text available: pdf(79.24 KB) Additional Information: full citation, abstract, references, index terms

Our HCI group developed mutually useful relationships with industrial partners, like MATÁV Hungarian Telecom, Paks Nuclear Power Plant, Graphisoft, Nokia, EuroControl, etc., successfully accomplishing various R&D projects in very different fields.We apply a variety of evaluation methods, including a complex methodology called INTERFACE developed by us. This system is based on the continuous and simultaneous recording of heart period variability, time data of keystroke and mouse events, vide ...

Keywords: empirical methods, quantitative and qualitative, usability testing and evaluation, user studies

13 Ergonomic standards for software: economic and design implications
Patricia A. Billingsley
May 1995 **Conference companion on Human factors in computing systems**
Full text available: pdf(57.13 KB) Additional Information: full citation, index terms

14 Preliminary findings on the effectiveness of ergonomic criteria for the evaluation of human-computer interfaces
J. M. Christian Bastien, Dominique L. Scapin
April 1993 **INTERACT '93 and CHI '93 conference companion on Human factors in computing systems**
Full text available: pdf(206.84 KB) Additional Information: full citation, references, citings

15 Expressing guidelines into an ergonomical styleguide for highly interactive applications
François Bodart, Jean M. Vanderdonckt
April 1993 **INTERACT '93 and CHI '93 conference companion on Human factors in**

computing systems

Full text available: pdf(210.16 KB) Additional Information: full citation, references, citings

16 Defining the ergonomic buzzwords

Jon A. Meads

January 1983 **Proceedings of the 1983 annual conference on Computers : Extending the human resource**

Full text available: pdf(573.74 KB) Additional Information: full citation, abstract, references, citings, index terms

Current software and computer systems are being advertised and sold today as FRIENDLY systems that are EASY TO USE. Most also claim to be EASY TO LEARN as well. But what is it that makes a system FRIENDLY, EASY TO USE, or EASY TO LEARN? Is it sufficient to enshrine a group of interactive features in a video box connected to a single user microcomputer? If a system is EASY TO USE does that make it FRIENDLY? Or does EASY TO LEARN mean that it is EASY TO USE? Does your friendly, easy-going per ...

17 Lighting characteristics of visual display terminals from an ergonomic point of view

U. Bräuninger, E. Grandjean

December 1983 **Proceedings of the SIGCHI conference on Human Factors in Computing Systems**

Full text available: pdf(240.01 KB) Additional Information: full citation, abstract, index terms

Measuring procedures were developed to assess those lighting characteristics of VDTs which are of importance for visual comfort and for legibility: Luminance oscillation, sharpness, contrasts, stability and dimensions of characters as well as reflections on the display surfaces. 30 different VDT models of various European and US manufacturers disclosed great differences, indicating a big potential for improving the ergonomic qualities of VDTs.

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